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February 3, 2017

VIA ELECTRONIC FILING

Ms. Marlene Dortch
Secretary
Federal Communications Commission
The Portals
445 12th Street SW
Washington DC 20554

Re: **In the Matter of Wireless E911 Location Accuracy Requirements, PS Docket No 07-114**

Dear Ms. Dortch:

Pursuant to the E911 Fourth Report and Order, AT&T is required to file an Initial Implementation Plan (§20.18(i)(4)(i)) and Progress Report (§20.18(i)(4)(ii) by February 3, 2017. Attached please find AT&T's Initial E911 Indoor Location Accuracy Implementation Plan and Progress Report.

Sincerely,

/s/ Joseph P. Marx
Assistant Vice President, AT&T Services Inc.

E911 Indoor Location Accuracy Initial Implementation Plan and Progress Report

1. Introduction

The FCC's Fourth Report and Order on Wireless E911 Location Accuracy requires that nationwide CMRS providers report to the Commission on their initial implementation plans and progress toward improving indoor location accuracy (see 47 C.F.R. §20.18(i)(4)(i) & §20.18(i)(4)(ii)). This implementation plan will lay out the steps that AT&T has taken since the adoption of the Order to improve location accuracy on its network and the plans it intends to take in the near future. In addition, the plan will highlight the steps it has taken with respect to implementing dispatchable location through the development of the National Emergency Address Database (NEAD).

2. Implementation of the Test Bed

2.1 Background & Purpose of the 9-1-1 Location Technologies Test Bed, LLC

In 2015, the Federal Communications Commission adopted the aforementioned Fourth Report and Order, which required the nationwide wireless providers to establish an independently administered and transparent indoor test bed (Test Bed).[1] The Test Bed verifies how wireless 9-1-1 location technologies and solutions perform against the FCC's location accuracy requirements for wireless calls to 9-1-1 made from indoor locations.

[1] *See*, FCC, *Fourth Report & Order on Wireless E911 Location Accuracy Requirements*, FCC 15-9 (rel. Feb. 3, 2015) (Order). The FCC's rules were based on the *Roadmap to Improve 911 Location Accuracy* developed by AT&T, Sprint, T-Mobile and Verizon, the Association of Public-Safety Communications Officials (APCO) and the National Emergency Number Association (NENA), available at http://apps.fcc.gov/ecfs/document/view?id=60000986637.

2.2 Test Bed LLC Organizational Structure

At the direction of its member companies, CTIA established the 9-1-1 Location Technologies Test Bed, LLC (Test Bed LLC) as an independent company to administer and operate the indoor Test Bed consistent with the FCC's rules. The Test Bed LLC selected the Alliance for Telecommunications Industry Solutions (ATIS) as the Test Bed program manager. In March 2016, after a competitive bidding process, the Test Bed LLC selected LCC Design Services, a Tech Mahindra Company, to administer and execute the Test Bed (LCC/TechM). This structure is modeled on organizational structure recommendations by the FCC's Communications Security, Reliability, & Interoperability Council (CSRIC) IV.

Modeled on recommendations by the FCC's CSRIC III, testing specifications are independently developed by the ATIS Emergency Services Interconnection Forum (ESIF), including ESIF's Emergency Services and Methodologies (ESM) subcommittee through an American National Standards Institute (ANSI) accredited standards process.

In addition to recommending the test methodologies, ATIS ESIF recommended how the Test Bed should be operated to facilitate orderly testing by wireless carriers and new technology vendors. Specifically, ATIS ESIF recommended that wireless carriers' existing 9-1-1 location technologies be tested in Stage 1, and new technology solutions should be tested in Stage 2 and subsequent stages. In addition, ATIS ESIF recommended that indoor testing occur across the Order's required four morphologies (dense urban, urban, suburban and rural) in two specific representative testing regions (Atlanta, GA and San Francisco, CA).

As Test Bed Program Manager, ATIS also provides guidelines on test building and test point selection and oversees implementation of the Test Bed by the Administrator (LCC/TechM). In addition, the Test Bed LLC receives advice and guidance from a Technical Advisory Committee (TAC) and Steering Committee (SC), both with representatives from wireless providers and public safety.

Through the Test Bed LLC, AT&T and the other national wireless providers have funded the Test Bed LLC's operations and administration and ATIS program management. With input from the Test Bed LLC's Steering and Technical Advisory Committees, the cost to support LCC/TechM's administration and execution of the test methodology is provided by each entity participating in the testing. In 2016, the national wireless carriers provided the funding for Stage 1 and technology solutions vendors provided funding for Stage 2. In subsequent stages, the funding will be provided by the requesting parties.

2.3 Indoor Location Test Methodology

ATIS ESIF has and continues to develop the requisite test methodologies through a collaborative multi-stakeholder process, inclusive of wireless carriers, 9-1-1 service providers, public safety representatives, and technology solutions vendors.

Adopted in June 2016, the *ATIS Standard on Test Bed and Monitoring Regions Definition and Methodology* (ATIS-0500031) provides the guidelines regarding Test Bed regions, morphologies, building types and construction materials (Test Cases). Specifically, the range of indoor operational environments in real world 9-1-1 call scenarios that would be identified for testing include:

- The four morphologies: Dense Urban, Urban, Suburban, and Rural.
- Within each morphology there are Setting/Use types – Commercial or Residential.
- Within a Commercial or Residential use type there are building categories. For example, Single Family Home, Multi Family home, Small office, Large commercial, or Arena, etc.
- Within each building category, there are different building types. For example – Low rise, high rise, glass exterior, brick, stucco, etc.

2.3.1 Building Candidates and Test Points Selection

Building candidates and test points were selected by the LCC/TechM, with review and approval by the Test Bed LLC's Program Manager, ATIS, based on the approaches initially established during CSRIC III and formalized in the test cases provided in ATIS-0500031.

For the various building types in each morphology, buildings with sufficient variation were identified to capture the natural variation in architecture/build and construction materials when wireless 9-1-1 calls are made indoors. Twenty buildings were selected in each region for testing in each Test Bed stage consistent with the types outlined in ATIS-0500031.
For each building, a number of test points were identified that reflect the anticipated range of location performance variation within the building, and generally span the different areas within the building from which an individual might initiate a wireless 9-1-1 call. The number of test points identified within a building were determined based on the size and type of building.

The Indoor testing framework is described in ATIS-0500013 defining indoor test methodologies and reproduced as Figure 1 below. The indoor testing framework is applicable to each of the morphologies.

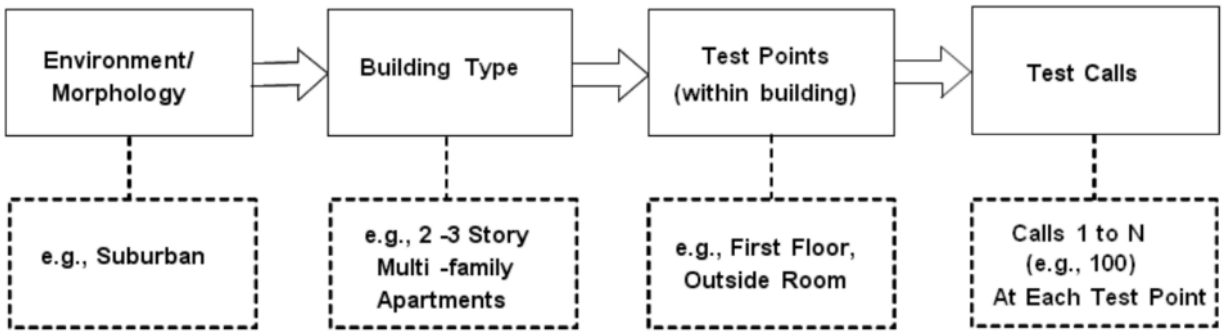


Figure 1. Indoor Testing Framework and Flow (from ATIS-0500013)

2.3.2 Data Collection Process

The specific buildings and test points were scouted and documented by LCC/Tech M and then reviewed and if appropriate approved by Test Bed LLC's program manager, ATIS. The specific buildings and test points were unknown to all test participants. As ground truth surveys of the test points were completed, testing started. A general call flow for placing test calls and collecting location data from Stage 1 is shown in Figure.

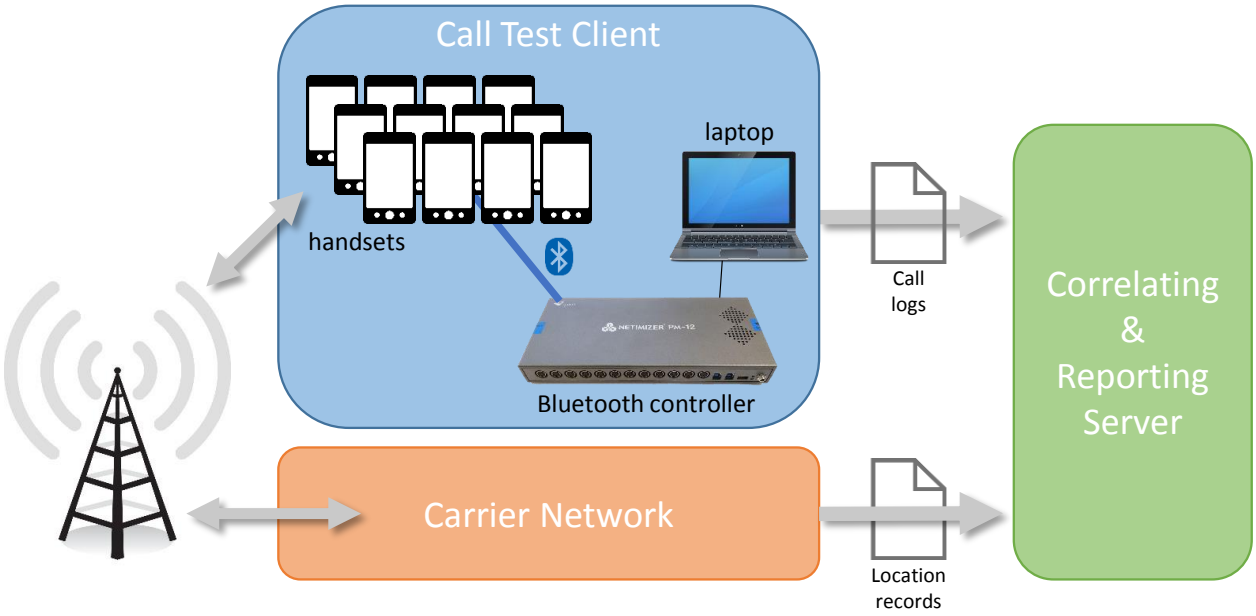


Figure 2. Stage 1 Data Collection Process Overview

The overall process consisted of testing both test regions (Atlanta, GA and San Francisco, CA) in parallel and using a standard configuration across all tested wireless handsets and carriers. This ensured that the testing process was consistent across all participants, as well as to minimize any opportunity for error or variability in results. The following are the common parameters used for placing test calls at each test point during Stage 1:

- Minimum 100 stationary, independent 9-1-1 test calls per device per test participant per test point;
- Call Duration of 45 seconds;
- Call Down Time of 45 seconds to help ensure independence between successive calls;
- Handsets and controller remained powered on between test points; and
- And the test cart with the handsets was rotated 90 degrees every 15 minutes during testing to ensure antenna diversity during the testing

Testing was closely monitored by LCC/TechM engineers, ensuring that all testing was completed per the specifications within the Test Plan developed consistent with ATIS-0500031. If it was discovered that data collected at a particular point did not meet all requirements and a re-test was required, the tester was redeployed to the location for re-testing.

2.4 Test Bed Stages

ATIS ESIF recommended how the Test Bed should be operated to facilitate orderly testing by wireless carriers and new technology vendors. Specifically, ATIS ESIF recommended that wireless carriers existing 9-1-1 location technologies be tested in Stage 1, and new technology solutions should be tested in a Stage 2 and subsequent stages.

Subsequent stages of testing will focus on emerging location technologies as well as Z-axis technologies and Dispatchable Location solutions utilizing the NEAD. The results of these subsequent test stages will enable wireless carriers to determine whether such emerging technologies can be used to improve the performance of indoor wireless location for 9-1-1 and to develop a recommended z-axis metric, as required by the FCC's Order. (47 C.F.R. §20.18(i)(2)(ii)(B).

2.5 Existing 9-1-1 Location Solution Technologies Tested in Stage 1

Stage 1 testing consisted of utilizing existing technologies as provided by commercially available handsets and technologies currently deployed on AT&T's network for locating 9-1-1 calls. The list of location technologies, specific to AT&T, fix types and associated voice technologies are listed below.

AGPS, AGNSS	Includes any type of Assisted Global Positioning / Navigation system used by the UE to determine location (AGPS, AGNSS). May include both UE-based and UE-assisted methods of position calculation. Typically includes network provided assistance data for ephemeris and timing reference. Primary location method for many 911 calls on carrier networks.
Cell ID or Cell/Sector	The use of the serving cell's location (possibly further narrowed by a sectorized RF coverage area) as an approximation for the caller's location. Note that for macro cells, this approximation is only a rough order of magnitude. For smaller (micro) cells, this location method can become quite accurate.
E-CID, RTT, CI-TA	Enhanced Cell ID (LTE), Round-Trip-Time (UMTS), CI-TA – Network based location method using sectorized RF coverage area and distance from the serving cell site calculated by measuring the round-trip-time of the radio signal between the base station and the handset. In some cases, neighboring base stations might also be used in the calculation to further refine the position estimate.
OTDOA	Observed Time Difference of Arrival – a downlink positioning method based on measuring the difference in time of arrival of LTE downlink signals received at the UE. A primary location fallback method for LTE.
Device-Based Hybrid	A UE-based location fix using any combination of available location methods to produce a high quality location estimate. Examples would include AGPS/WiFi, where the presence of WiFi positioning, utilizing a crowdsourced database of known access points, aids the performance of AGPS in challenging indoor environments. Other device-based sensors or measurements might also be included in the hybrid combination.

2.6 Test Results and Confidentiality

The Stage 1 indoor location performance data enables AT&T to determine compliance with the FCC's Order.

Consistent with paras. 131-132 of the Order, the Stage 1 test results are kept confidential to the carrier or technology solutions vendor, subject to aggregate Stage 1 test data being made available to the Test Bed LLC and non-nationwide wireless providers.[2]

Generally, the technologies tested in Stage 1 performed as expected within the indoor environments. For example, AGPS/AGNSS solutions performed better indoors in the urban, suburban and rural morphologies than in the dense urban morphology. Of the deployed location technologies tested in Stage 1, device-based hybrid (DBH) solutions showed significant promise to improve indoor wireless 9-1-1 location accuracy across all morphologies, particularly in the dense urban morphology.

As noted in the FCC's Order, AT&T will blend Stage 1 indoor performance data with outdoor performance data and apply the resulting performance metric to live 9-1-1 call data. AT&T will be using the methodology recommended by ATIS in Section 8 of ATIS-050031.

Stage 2 of the Test Bed involved testing emerging location technologies from four vendors, including Wi-Fi-only solutions, Wi-Fi/AGPS hybrid solutions, a device-based hybrid solution, and a metropolitan beacon solution with a hybrid AGPS solution.[3] Stage 2 testing was performed according to the same ATIS-defined methodology (per ATIS-0500031) as Stage 1.

3. Location Technologies

3.1 Assisted Global Positioning System

There continue to be improvements made in the Assisted Global Positioning System (AGPS) chipsets in newer generations of handsets. One of the biggest improvements comes as a result of lower power requirements and better battery management associated with the GPS

[2] Non-nationwide wireless providers seeking Stage 1 indoor performance data from the Test Bed should visit http://www.911locationtestbed.org/nnpdata.html.

[3] Z-axis information was tested on a limited basis in Stage 2 dependent on whether such information was available for a specific solution, region and morphology. As outlined in ATIS-0500030 "*Guidelines for Testing Barometric Pressure-Based Z-Axis Solutions*", a comprehensive Z-axis specific field test axis solutions is planned, subject to availability of production handsets that include Z-axis supporting technologies. CTIA's Z-Axis Working Group will evaluate the results of a comprehensive Z-axis specific field test to develop and propose Z-axis accuracy metrics to the FCC by August 3, 2018 (*See* 47 C.F.R. §20.18(i)(2)(ii)(B)).

Chipsets. As a result, this allows the handsets to keep AGPS measurements active for extended periods of time, keeping a "hot status" of location in the handset. This allows for the location to be available much quicker after the person dials '911'. This capability also makes the device based hybrid capabilities better since they have more accurate location available for "crowd-sourcing".

In addition, each new generation of GPS chipsets includes minor enhancements for improving the accuracy and sensitivity available from the chipset by including improvements such as multipath mitigation. As the handset vendors integrate the next generation of chipsets into their devices, AT&T will continue to monitor the accuracy to see whether additional baseline testing for AGPS is necessary in the Test Bed.

3.2 Other GNSS Constellations

Likely the single biggest improvement to AGPS would result from the inclusion of a secondary satellite system to augment the number of satellites available to the handset for GPS measurements. And the industry used a significant number of resources to test the "next" available GNSS Satellite System, GLONASS back in 2014 and 2015. While GLONASS provided nearly a 50% increase in the probability that a handset would see three or more satellite measurements (a minimum of three measurements are needed for a location) and showed improvements in accuracy, no permission was given to deploy GLONASS, due to national security concerns. We continue to be engaged with the FCC and other governmental agencies to determine whether there are opportunities to take advantage of this potential "life-saving" technology that has been available for more than two years.

3.3 Device Based Hybrid

Device Based Hybrid technologies are proprietary location technologies available at the chipset, operating system, or application layer that take advantage of various technologies (AGPS, Bluetooth, accelerometers, barometers, etc.) and proprietary algorithms to estimate locations. These proprietary algorithms use the capabilities in the handset to build crowd-sourced location databases that provide accurate location estimates in both indoor and outdoor venues. These are the same technologies available for existing location based

services (e.g. – Uber, Google Maps, etc.) and are now becoming available for 911 calls. They normally generate a very accurate estimate of the latitude and longitude, which will improve indoor location accuracy where AGPS alone may not provide a location estimate.
The initial device based hybrid capability was tested in the Test Bed and is being used for certain handsets dialing '911' today. Additional discussion is occurring with various vendors to provide device based hybrid solutions for many additional handsets in the coming years.

3.4 Observed Time Difference of Arrival (OTDOA)

Observed Time Difference of Arrival (OTDOA) technology is a positioning feature that was introduced in the Release 9 of the 3GPP LTE Standards. It is a multi-lateration method in which the handset measures the time difference between Positioning Reference Signals (PRS) received from several cell sites and relays them to the Serving Mobile Location Center (eSMLC). The eSMLC uses the known location data for the cell sites and these time differences to estimate the handset location. The primary focus for this year was to complete the deployment and provide a baseline of the accuracy for OTDOA in the CTIA Test Bed.
There are several enhancements planned for the OTDOA technology that will be deployed early in 2017, which include "cell barring to the primary channel", "muting", and "inter-frequency" support. The cell barring to primary channel feature would force all '911' calls to be placed on the primary channel (or band) rather than handing off to one of the other bands currently in use for LTE. The muting feature uses a round robin algorithm for PRS signals on each cell site so that these signals do not interfere with each other and provides a clear channel for handset measurements. And finally, the inter-frequency support feature allows the handsets to measure the time differences on PRS signals on other frequency bands improving the likelihood that we get OTDOA measurements and better signal diversity from using different frequencies.
Significant improvements are expected from the combinations of new features and, as a result, these new features will need to be retested in the Test Bed to get updated baseline accuracy data.

3.5 NextNav

The NextNav Metropolitan Beacon System (MBS) is a terrestrial based beacon system that works very similar to the way GNSS Satellite systems operate. At the highest level the NextNav MBS System is a multi-lateration system that uses time (time difference of arrival) that is synchronized to GPS to allow very precise timing and therefore very accurate location estimates. The terrestrial beacons transmit at sufficient signal strength to allow for reliable reception indoors and in urban canyons where clear view of the GPS satellites is not available.

AT&T supported NextNav at getting their MBS technology integrated into the 3GPP Release 13 specification. AT&T continues to test and evaluate the NextNav technology and was supportive of formally testing the solution in the Test Bed. Unfortunately, the technology has not been widely incorporated into commercial handsets and while we continue to monitor this technology, it is not operational within our network at this time.

4. Implementation of Dispatchable Location

4.1 Background & Purpose of the NEAD LLC

In the Order, the FCC also adopted new rules that require wireless providers to generate either a Dispatchable Location or x/y location information within 50 meters for a certain percentage of wireless calls to 9-1-1 within specific timeframes.[4]

Dispatchable Location solutions provide the verified street address plus additional location information of wireless access points (*e.g.*, Wi-Fi, Bluetooth Low Energy (LE) beacons) that will help to locate a caller during a wireless call to 9-1-1. By developing Dispatchable Location solutions, wireless providers are harnessing *indoor* wireless technologies to enhance public safety's ability to efficiently and safely respond to wireless calls to 9-1-1 from *indoor* locations.

[4] *See*, FCC, *Fourth Report & Order on Wireless E911 Location Accuracy Requirements* (rel. Feb. 3, 2015) (Order). The FCC's rules were based on the *Roadmap to Improve 911 Location Accuracy* developed by AT&T, Sprint, T-Mobile and Verizon, the Association of Public-Safety Communications Officials (APCO) and the National Emergency Number Association (NENA) available at http://apps.fcc.gov/ecfs/document/view?id=60000986637.

In the Order, the FCC recognized the commitment of AT&T and the other national wireless providers to implement the NEAD, a database of wireless access points to support wireless providers' ability to produce a Dispatchable Location for public safety answering points (PSAPs). At the direction of AT&T and the other carriers, CTIA established the National Emergency Address Database, LLC (NEAD LLC) as an independent company to administer and operate the NEAD consistent with the FCC's rules.

In October 2015, the NEAD LLC selected ATIS as the NEAD program manager and began a year-long competitive bidding process to select a vendor to develop and operate the NEAD. In October 2016, the NEAD LLC selected West Safety Services (West) as the vendor. The NEAD LLC has contracted with West to implement the NEAD Platform in accordance with the FCC's rules, including privacy and security requirements, and relevant technical standards.

4.2 NEAD LLC Organizational Structure

The NEAD LLC is supported by a Program Manager *(i.e.*, ATIS), a Vendor (*i.e.*, West), a Technical Advisory Committee, and a Steering Committee, the latter two of which are both comprised of public safety and wireless provider stakeholders (including AT&T). This structure is modeled on the "Management Framework for the Indoor Location Accuracy Test Bed" recommended by Working Group 1 of the FCC's Communications, Security, Reliability & Interoperability Council (CSRIC) IV.

As NEAD Program Manager, ATIS oversees and supports implementation of the NEAD Platform by West. Specifically, ATIS provides support and coordination for NEAD project management, technical specifications and standards development, database operations and outreach to wireless access point owners and administrators. As described below, NEAD design and technical specifications are based on the standards independently developed by ATIS' Emergency Location (ELOC) Task Force, through the ANSI accredited standards setting process.

The FCC's Order also recognized the joint commitment of the national wireless providers, APCO and NENA to work collaboratively to establish and maintain the operational and technical functions of the NEAD Platform. Consistent with this commitment, the NEAD LLC receives advice and guidance

from a Technical Advisory Committee (TAC) and Steering Committee (SC), both of which include representatives from wireless provider and public safety stakeholders.

Through the NEAD LLC, AT&T and the other national wireless providers have funded the NEAD LLC's operations and administration, ATIS program management, as well as initial design, development and operation of the NEAD Platform by West. With input from the NEAD LLC's Steering Committee, a cost sharing model is being developed to ensure on-going NEAD costs are allocated equitably among providers who support or utilize the NEAD for Dispatchable Location solutions.

4.3 How the NEAD Platform Works

When someone calls 9-1-1 from their wireless handset equipped with Wi-Fi or Bluetooth technologies, AT&T's network will automatically collect information from the wireless handset about nearby wireless access points (i.e., any Media Access Control (MAC) addresses of Wi-Fi Access Points and any Bluetooth Public Device Addresses (BT-PDA) of Bluetooth beacons) within the vicinity of the wireless caller.

AT&T's network will query the NEAD Platform to determine whether the MAC address or BT-PDA of any of these wireless access points is in the NEAD database and is associated with a verified street address including any additional location information. If so, our network will determine which wireless access point street address information to provide as a Dispatchable Location of the wireless caller for the 9-1-1 call.

4.4 NEAD Platform Design & Technical Specifications

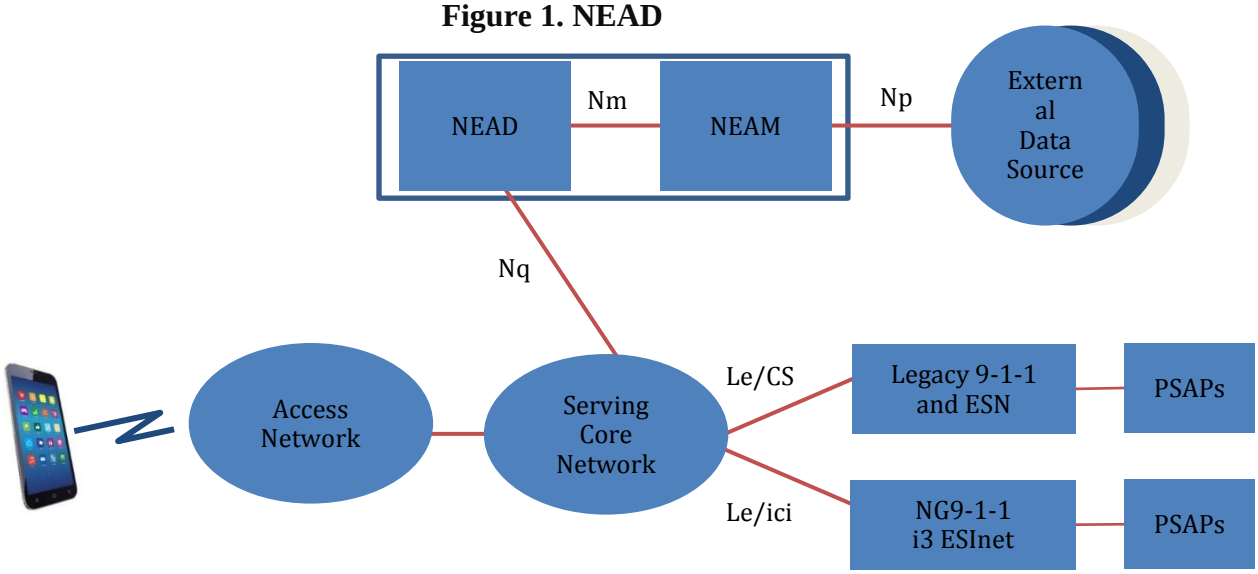
Through a collaborative multi-stakeholder process, ATIS ELOC has and continues to develop the requisite standards upon which NEAD design and technical specifications are based. ELOC membership includes AT&T and the other wireless carriers, 9-1-1 service providers, public safety representatives, and technology solutions vendors.

On Nov. 3, 2016, ATIS released *Location Accuracy Improvements for Emergency Calls* (ATIS-0700028 v1.1), which is the standard that defines the architecture and requirements for the NEAD, as well as

how information in the database is processed. The NEAD LLC has contracted with West to develop the NEAD consistent with ATIS-0700028.

In accordance with ATIS-0700028, the NEAD Platform has two components: the National Emergency Address Database (NEAD) and the National Emergency Address Manager (NEAM). The reference model below (**Error! Reference source not found.**) is an overview of the functional structure and the involved entities, interfaces and connections associated with the NEAD Platform.

Figure 1. NEAD



As a component of the NEAD Platform, the database contains verified street addresses and additional location information of wireless access points. The NEAD will be designed to respond only to 9-1-1 call-related requests from participating and authorized service providers.

The NEAM, the management component of the NEAD Platform, is the set of systems that will receive, process, and verify information on wireless access points that are submitted for inclusion in the NEAD. Such information will generally come from three external sources: (i) service provider records of wireless access points, including MAC address, BT-PDA and location information, but no other customer-specific information; (ii) large enterprise system

(e.g. hotels, restaurants, and retail stores) records of wireless access points, including MAC address, BT-PDA and location information, but no other customer-specific information; and (iii) eventually, individual consumers, who, on a voluntary basis will be able to input information about their wireless access points not otherwise provided to the NEAD along with information necessary for verification. A public portal (e.g. website or similar function) will be developed that will enable external sources to submit and manage wireless access points via the NEAM.

4.5 Testing Wireless Carriers' Dispatchable Location Solutions

Similar to other 9-1-1 location technologies, AT&T will test its Dispatchable Location solutions in the Test Bed. Testing these solutions will verify that NEAD information can be utilized to provide a Dispatchable Location consistent with the Order and parameters adopted by ATIS ELOC in Annex D of ATIS-0700028.

At present, ATIS's ESIF is working on the methodology to test Dispatchable Location solutions in the Test Bed. Testing Dispatchable Location solutions is dependent on the NEAD being operational for testing purposes and readiness of the wireless networks to support the NEAD, which is expected to occur in 2017.

4.6 NEAD Privacy & Security Plan

Before AT&T can use the NEAD Platform for its Dispatchable Location solutions, the FCC's Order requires it (as well as the remaining national wireless providers) to certify that NEAD information will only be used for 9-1-1 purposes and conditions their ability to utilize the NEAD on the FCC's approval of a NEAD-specific privacy and security plan. (47 C.F.R. §20.18(h)(3)(i)(4)(iii)).

The NEAD Privacy & Security Plan describes the related operation and administrative functions of the NEAD Platform to safeguard personal information and maintain a reliable, resilient system. The NEAD LLC is expected to submit the NEAD Privacy & Security Plan for FCC review on February 3, 2017.

4.7 Access Point Acquisition and Outreach to Wireless Access Point Owners

The FCC's Order recognizes that the likelihood of Dispatchable Location being provided to a PSAP during a wireless 9-1-1 call is relative to the number of wireless access points within the NEAD. Over time, AT&T's Dispatchable Location solutions will evolve into greater levels of precision as emerging location solutions enter into the emergency location ecosystem and the number of wireless access points within the NEAD increases, especially with the introduction of Bluetooth beacons.

To this end, the FCC's Order requires the NEAD to maintain a minimum number of wireless access points in the top 50 Cellular Market Areas (CMAs) by April 2023. Specifically, the Order requires the NEAD to be populated with a minimum number of wireless access points in each of the Top 50 CMAs equal to 25% of the particular CMA population. (47 C.F.R. §20.18(i)(2)(ii)(C)-(D))

To provide an initial base of wireless access points, the national wireless providers will submit information about their wireless access points to the NEAD in 2017. In addition, the NEAD LLC, working with ATIS's NEAD Outreach Manager, has begun developing an outreach strategy to encourage wireless access point owners and administrators, such as broadband service providers, large enterprises and public institutions, to contribute such data to the NEAD.

The NEAD LLC expects that outreach and engagement with wireless access point owners and administrators will be a wide-ranging, multi-stakeholder, and multi-year effort. The NEAD LLC intends to engage stakeholders from industry, public safety, and enterprises to support this effort. CTIA's 9-1-1 Location Accuracy Advisory Group is also expected to provide guidance and support for the NEAD LLC's outreach and engagement efforts.

Currently, AT&T has three different sources of Wi-Fi information which include the physical address information of the access point and its associated MAC address. These sources include AT&T Managed Wi-Fi Access Points, AT&T's customers using Wi-Fi Calling (AT&T's methods and procedures require these customers to register their location), and U-Verse Broadband customers. AT&T has assembled a project team to develop tools and processes to pull the appropriate location data for the NEAD database. This team has

been working with the AT&T leadership team of the Managed Wi-Fi market segment to ensure that location data is pulled and compiled correctly through the use of these tools and processes. AT&T has prioritized implementation of the AT&T Managed Wi-Fi and its Wi-Fi Calling Customers and is still in the early stages of developing processes for U-Verse Broadband customers.

Additionally, AT&T is partnering with other wireless carriers to develop recommendations for incorporating location information for Bluetooth beacons into the NEAD. Industry and financial analysts are projecting substantial growth for Bluetooth "smart home," "smart office," and retail use cases that will lead to a significant increase in the number of Bluetooth beacons installed in residential and commercial environments. AT&T expects Bluetooth to play a significant role in improving indoor location accuracy once the appropriate standards for use cases and inclusion of location data into the NEAD are completed.

Finally, the wireless carriers are also collaborating with various industry partners (*e.g.*, managed Wi-Fi providers and 911 solutions vendors) to help develop a standardized solution for using the vast number of signals and data available in an enterprise setting (e.g., a corporate campus) to provide enhanced location information to the NEAD that can be used in the event an E911 call is placed in an enterprise customer location.

5. Progress on Z-Axis Solutions

AT&T is participating in the CTIA Z-axis working group, which has been actively working to develop plans to deliver uncompensated barometric pressure (UBP) data to PSAPs and to evaluate vertical location technology from the Test Bed. This group is closely coordinating with the ATIS ESIF-ESM subcommittee and CTIA's Standards Working Group, Test Bed Working Group, and PSAP Implementation Working Group to achieve these objectives.

The work group participants include diverse representation from public safety, the wireless industry, technology vendors, and others. In December of 2015, this working group completed an internal systems analysis document outlining the system engineering efforts and coordination activities required for the delivery of UBP from a handset to a PSAP during a wireless 911 call. This document provides an overview of the implementation of UBP

delivery, details the system architecture, and identifies the changes to the various standards and protocols as well as the handset and network impacts of delivering UBP.

As briefly noted above, the CTIA Z-axis working group has also been closely working with the ATIS ESIF-ESM subcommittee to develop the appropriate guidelines for testing and evaluating Z-axis location solutions in the Test Bed, relying heavily on ATIS Standard 0500030 (Guidelines for Testing Barometric Pressure-Based Z-Axis Solutions. Based on Test Bed results, the working group will develop and submit, for FCC approval, one or more z-axis accuracy metrics for use in determining compliance of any z-axis implementation, if applicable.

5.1 Potential Z-Axis Solutions

AT&T is exploring several options for delivering a calibrated Z-axis as part of a solution to provide a dispatchable location. The most obvious solution for providing dispatchable location continues to be the NEAD, which will not only provide the validated civic address but will also provide supplementary location information (*e.g.*, the floor or suite information associated with the caller).

In addition, AT&T continues to support NextNav's development of its MBS solution, providing technical evaluations and testing support in the AT&T Lab as well as in the field. AT&T Labs has also met with Polaris to discuss its Z-axis solution which was tested alongside NextNav in the Test Bed. The Polaris solution is the first crowd sourcing solution to attempt to provide a Z-axis location estimate, and there are signs of progress. However, based on discussions with our major device handset vendors who are implementing device-based hybrid solutions, Z-axis location estimates continue to be a major obstacle to resolve with a crowd-based approach.

6. Standards Activity

AT&T has been actively involved in the standards development efforts related to 911 Location Accuracy and has participated in following standards groups.

- ATIS Emergency Services Interconnection Forum (ESIF) Emergency Services and Methodologies (ESM) Subcommittee
    - AT&T is the co-chair of the ATIS standards working group ESIF-ESM. ATIS ESIF-ESM is instrumental in driving the industry standards for E911 location technology. In the past 18 months, the committee has worked closely with the Test Bed LLC by defining the E911 indoor testing requirements for determining accuracy and performance of E911 location solutions, the methodologies for blending performance data, the clear definitions of morphology environments, and defining the Test Bed testing boundaries, morphology coverage, as well as the recommended building types to be used in testing. ATIS ESIF-ESM is also addressing the performance testing and reporting for localized E911 location solutions (*i.e.*, solutions designed for specific types of venues such as convention centers and sports arenas) as well as low energy beacon solutions. This committee is a long standing committee with major successes in driving E911 standards, addressing current and potential future issues, and a history for delivering standards-based solutions within 12 months of issue adoption. The committee is comprised of public safety stakeholders (NENA & APCO), vendors of E911 technology solutions, as well as the wireless carrier community.
- ATIS Emergency Location (ELOC) Task Force
    - AT&T is the co-chair of the Task Force, and provides numerous technical working group participants to it. ELOC is a joint effort between two ATIS standards committees (ESIF & the Wireless Technologies and Systems Committee (WTSC)) which is also comprised of public safety stakeholders (*e.g.*, NENA & APCO), vendors of E911 technologies, as well as wireline and wireless carriers. In the past 18 months, ELOC has worked closely with the NEAD LLC in the development and delivery of the technical requirements and recommended architecture of the NEAD. The Task Force addresses the use of wireless beacon technologies, along with a physical address database,

to identify the location of an E911 caller and provide dispatchable location information to the PSAP call taker. The Task Force's work has resulted in the publication of ATIS-07-00028v1.1, "Location Accuracy Improvements for Emergency Calls" (ELOC Phase 1) in September 2016. The Task Force is currently working on "Guidelines for Emergency Call Location Selection and Reporting by Originating Networks" (ELOC Phase 1.2) and "E911 Standards and Recommendations for Interfacing Enterprise Networks with the NEAD" (ELOC Phase 2).